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Performance of Bali heifers based on body dimensions in Nusa Penida Island, Bali Province, Indonesia

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Abstract
The research objectives is to determine the body dimensions (body length, withers height, chest circumference and width of the pelvic bone) performance of Bali heifers as a candidate to Bali dams on Nusa Penida Island, Bali Province, Indonesia. This study used 185 bali heifers and was carried out in four villages in Nusa Penida. which lasted for 5 months. The study was conducted by direct measurement of of prospective Bali heifers in the village. The independent variables used in this study were teeth (tooth 1 and tooth 2). The dependent variable is the body dimensions of prospective Bali heifers, while the control variable is livestock maintenance management (the feed provided is assumed to be the same). Data were analyzed descriptively to obtain average body dimensions of Bali heifers. The average body length of bali heifers by age group (I1and I2) obtained in this study were 112.03±4.26 cm and 112.99±5.00 cm. The average withers height is 109.99±3.68 cm and 111.04±3.70 cm. The results showed that the average chest circumference of I1 and I2 150.56±8.98 cm and 153.02±7.71 cm. In addition, pelvic bone width obtained in this study in the age groups I1and I2 were 36,64±3,07 cm and 37,31±3,20 cm. The average body dimensions of Bali heifers on Nusa Penida Island are higher than the minimum quantitative requirements of Bali heifers according to SNI 7651.4:2015 standards. This shows that the Bali heifers on Nusa Penida Island, Bali Province, Indonesia are very good for breeding cattle.

Keywords: Bali heifers, breeding, body dimensions

Introduction
Bali cattle is a type of beef cattle that must be preserved and developed because Bali cattle are Indonesian germplasm that belong to the genetic resources (SDG) of local beef cattle (Bidura, 2019) [3]. The results of previous studies indicate that there has been a decrease in body weight of mature Bali cattle, which indicates that Bali cattle have decreased genetic quality. Meijer (1962) [5] found that the body size of Bali bull including body length, withers height, chest circumference and hip height is 145; 135; 195; and 132 cm, respectively, and the body size of Bali cow is 125; 129; 160; and 116 cm respectively. Djagra (2002) [2] found that the body size of mature bali cattle were 121.7cm; 117.7 cm; 170.3 cm and 117.5 cm, while the body size of bali cows is 114.7 cm; 110.4 cm; 154.3 cm and 110.8 cm. Warmadewi *et al*. (2017) [6] stated that body length,withers height and chest circumference of female bali cattle were 117,19±8,84 cm; 115,12±6,35 cm dan 165,43±12,54 cm respectively.

The selection and breeding program is an action of breeding that can be done to increase the genetic quality of Bali cattle. Besides this program can be used as an effort to preserve and develop livestock populations (Warmadewi *et al.*, 2017) [8]. Tama *et al.* (2016) [6] states that chest circumference has a close relationship with body weight. Warmadewi *et al*. (2017) [7] states that chest circumference is better used as a selection criterion than body length and shoulder height. In the prospective parentstock selection, it is good to consider the width of the pelvic bone because it is associated with difficulties in calving (dystocia).

Based on the above mentioned, so that the research was carried out on Nusa Penida Island by measuring the performance of Bali heifers namely body length, withers height, chest circumference and pelvic bone width to found bali dams for increase genetic quality of Bali cattle.

Methode and Procedure
Experimental design and animals. This study used 185 bali heifers in four villages in Nusa Penida sub-district namely Ped, Pejukutan, Batumadeg and Batukandik, Bali Province, Indonesia which lasted for 5 months.

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The study was conducted by direct measurement of body dimensions (body length, withers height, chest circumference and width of the pelvic bone) of prospective Bali cows in the village. More detailed heifers that have been used as research material look like in Figure 1.

Fig 1: Performance of Bali heifer in Nusa Panida Island, Bali Province, Indonesia

The independent variables used in this study were teeth (tooth 1 and tooth 2). The dependent variable is the body dimensions (body length, withers height, chest circumference and width of the pelvic bone), while the control variable is livestock maintenance management (the feed provided is assumed to be the same).

Data analysis
The data obtained were analyzed descriptively. Performance of body length, withers height and chest circumference were calculated by finding the average of each variable using the formula: $\bar{X} = \frac{\Sigma x}{n}$; where $\bar{X}$ = average; Σx = total number of values obtained and n is the number of animals measured. Standard deviation (sd) is obtained by using the formula:

$$\sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n-1}}$$

Results and Discussion
Average body dimensions of Bali heifers. The average body dimensions of Bali heifers in Nusa Penida Island, Bali Province, Indonesia were presented in Table 1.

Table 1: Average body dimensions of bali heifers in different age groups

Traits (cm)	Age group			
	I1		I2	
	n	$\bar{X}$	n	$\bar{X}$
body length	94	112.03±4.26	91	112.99±5.00
withers height		109.99±3.68		111.04±3.70
chest circumference		150.56±8,98		153.02±7.71
pelvic bone width		36.64±3.07		37.31±3.20

Note:
n = Number (head)
X = Average
± = Standard Deviation

The average body length of bali heifers by age group (I1 and I2) obtained in this study were 112.03± 4.26 cm and 112.99±5.00 cm. The average body length obtained in this study in the I1 age group was 0.03% higher than the minimum quantitative requirements for female cattle breed for class I according to SNI for beef cattle specifically for Bali cattle.

Whereas in the I2 age group, the average body length obtained was lower than class 1, but higher than class 2. The average withers height are 109.99±3.68 cm and 111.04±3.70 cm. The average withers height in the I1 age group obtained in this study was 2.79% higher than the SNI, likewise in the I2 age group the results obtained were 0.95% higher than the standards set by the SNI. The results showed that the average chest circumference of I1 and I2 were: 150.56±8.98 cm; 153.02±7.71 cm. The mean chest circumference in the I1 age group obtained in this study was 8.32% higher compared to the SNI class 1 standard, while for the I2 group the results were 4.10% higher compared to the SNI class 1 standard. In addition, pelvic bone width obtained in this study in the age groups I0, I1, I2 and I3 were 23.50%; 22.13%; 16.86%; and 14.60% higher than the results of Gayatri (2016) [4].

The average body dimensions (body length, withers height and chest circumference) obtained in this study are higher than the standards set by SNI for the minimum quantitative requirements for body dimensions (body length, withers height and chest circumference) for Bali dams of class I, especially for the I1 and I2 age groups.

Based on SNI 7651.4: 2015 [1] concerning beef cattle specifically for Bali cattle, the minimum quantitative requirements for body dimensions (body length, withers height and chest circumference), Bali heifers at the age of 18-24 months (I1) for class I are 112cm, 107cm and 139cm respectively, while those aged of 24-36 months (I2) are: 114 cm, 110 cm and 147 cm respectively. This proves that Bali heifers on Nusa Penida Island are indeed prospective mothers who can be used as superior females. This heifers if mated with bull through natural mating or artificial insemination (IB) is expected to improve the genetic quality of Bali cattle.

Body dimensions (body length, withers height and chest circumference) in the I0 age group cannot be compared with SNI 7651.4: 2015, because body dimensions in the I0 age composition are not listed in the minimum requirements for Bali dams body dimensions in SNI7651.4: 2015. It could be because of the appearance of individuals in the age group I0 can not be used as a reference for selection. The effect of the theirparent are still appear in individuals in the I0 age group. Whereas at the age of I1 and I2, heifers already can meet their own nutritional needs and can adapt to their own environment without the influence of their parents. Effective selection is done in the I1 and I2 age groups. The higher body dimensions, especially the chestcircumference the better and the quicker their growth because the chest circumference has a very close relationship with body weight. This statement is in accordance with the results obtained by Tama *et al.* (2016) [6], Gayatri (2016) [4] and Warmadewi *et al.* (2017) [7]. The pelvic bone width obtained in this study was higher than the results of Gayatri (2016) [4]. This shows that Bali cow on Nusa Penida Island are good parentstock candidates. The width of the pelvic bone is related to the process of give birth. If pelvic bone is narrow, it is fear that dystocia or difficulty giving birth will occur (Warmadewi *et al.*, 2017) [8].

Conclusion
The average body dimensions (body length, shoulder height and chest circumference) of Bali heifers on Nusa Penida Island, Bali Province, Indonesia were higher than the minimum quantitative requirements of Bali dams according to SNI 7651.4: 2015 standards. This shows that the Bali heifers on Nusa Penida Island are very good for breeding cattle

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